

To change a number in **standard form to scientific notation**, first move the decimal point to the **left** to make a number greater than or equal to 1 and less than 10.

$$\underline{316,000,000} \rightarrow 3.16$$

Then multiply the number by 10 raised to a power, 10^n . The exponent, n , is equal to the number of places the decimal moved. Write the number as the product of the decimal and the power of 10.

$$316,000,000 = 3.16 \times 10^8$$

To change a number from **scientific notation to standard notation**, just reverse the steps. Move the decimal point the same number of places to the right as the number in the exponent.

$$3.16 \times 10^8 = 316,000,000$$

When 10 is raised to a power, the result is 1 followed by the number of zeros that equals the exponent.

$$10^6 = 1 \text{ followed by 6 zeros,} \\ \text{so } 10^6 = 1,000,000.$$

To express very small numbers in scientific notation, move the decimal point to the **right** to make a number greater than or equal to 1 and less than 10.

$$\underline{0.00075} = 7.5 \times 10^{-4}$$

The decimal point moved 4 places to the right, so the exponent is -4.

Read each problem. Circle the letter of the best answer.

- 1** The total area of the United States of America is more than 3,500,000 square miles. What is 3,500,000 written in scientific notation?

A 3.5×10^6 **C** 35×10^6
B 3.5×10^7 **D** 35×10^7

The decimal point must be moved 6 places to the left to make a number between 1 and 10, so the exponent is 6. Choices C and D are not in scientific notation because 35 is not between 1 and 10. The correct answer is A.

- 2** What is 0.000004 written in scientific notation?

A 0.4×10^{-5} **C** 4×10^{-5}
B 0.4×10^{-6} **D** 4×10^{-6}

- 3** The sun is about 4.5×10^9 years old. What is this number written in standard form?

A 450,000,000
B 4,500,000,000
C 45,000,000,000
D 450,000,000,000

- 4** The mass of an organism is 9.15×10^{-4} kilograms. What is this mass written in standard form?

A 0.0000915
B 0.000915
C 0.00915
D 0.0915

Read each problem. Write your answers.

5 Light travels at a speed of about 300,000 kilometers per second.

A What is this number written in scientific notation?

Answer: _____

B Explain how you found your answer.

6 The mass of Earth is about 5.974×10^{24} kilograms.

A Tessa rewrote this number in standard form. How many zeros did she write after the last non-zero digit in this number?

Answer: _____

B Explain how you know your answer is correct.

C The mass of Saturn is about 100 times greater than the mass of Earth. Write the approximate mass of Saturn, in kilograms, in scientific notation. Explain how you found your answer.

Comparing Numbers in Scientific Notation

To **compare** numbers written in scientific notation, first look at the exponents of each number. The greater the exponent, the larger the number.

If the exponents are the same, compare the decimal numbers between 1 and 10.

Which number is the smallest?

$$6.3 \times 10^8 \quad 1.25 \times 10^9 \quad 5.8 \times 10^8$$

Two numbers have the smallest exponent, 8. Compare their decimal values:

$$6.3 > 5.8, \text{ so } 5.8 \times 10^8 \text{ is the smallest number.}$$

Our number system is based on powers of 10.

$$\begin{aligned} 10^0 &= 1 \\ 10^1 &= 10 \\ 10^2 &= 100 \\ 10^3 &= 1,000 \\ 10^4 &= 10,000 \end{aligned}$$

Use negative powers of 10 to write small numbers in scientific notation.

$$\begin{aligned} 10^{-1} &= \frac{1}{10^1} = \frac{1}{10} = 0.1 \\ 10^{-2} &= \frac{1}{10^2} = \frac{1}{100} = 0.01 \\ 10^{-3} &= \frac{1}{10^3} = \frac{1}{1,000} = 0.001 \end{aligned}$$

Read each problem. Circle the letter of the best answer.

- 1 The table below shows the weight, in kilograms, of four particles.

PARTICLE WEIGHTS

Particle	Weight (kg)
A	4.45×10^{-6}
B	3.67×10^{-5}
C	8.23×10^{-6}
D	6.08×10^{-5}

Which of these particles is the **heaviest**?

- A particle A C particle C
B particle B D particle D

First compare exponents: $-5 > -6$, so particles B and D are heavier than A and C. Next compare decimals: $6.08 > 3.67$. Particle D is the heaviest. The correct answer is D.

- 2 Which of these numbers is the **smallest**?

- A 2.4×10^{11} C 7.1×10^{10}
B 3.7×10^{11} D 9.5×10^{10}

- 3 The amount of sales, in dollars, a music store had during the past three years is listed below.

- Year 1: 7.02×10^6
- Year 2: 4.4×10^6
- Year 3: 1.6×10^7

Which shows these years in order from **least to greatest** sales?

- A year 1, year 2, year 3
B year 2, year 3, year 1
C year 3, year 2, year 1
D year 2, year 1, year 3

Read each problem. Write your answers.

4 Janet made this list of numbers.

$$5.5 \times 10^{-5}$$

$$1.9 \times 10^{-4}$$

$$8.2 \times 10^{-6}$$

$$3.6 \times 10^{-5}$$

A Between which two numbers does 7.3×10^{-5} lie?

Answer: _____

B Explain how you found your answer.

5 The approximate distance of some stars from Earth are shown in the table below.

DISTANCE OF STARS FROM EARTH

Star	Distance (miles)
A	7.9×10^{15}
B	8.3×10^{16}
C	3.12×10^{15}
D	5.8×10^{14}
E	6.05×10^{15}

A Which stars are farther from Earth than star E?

Answer: _____

B List these stars in order from **closest to farthest**.

Answer: _____

C Explain how you found your answer.
